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## ABSTRACT

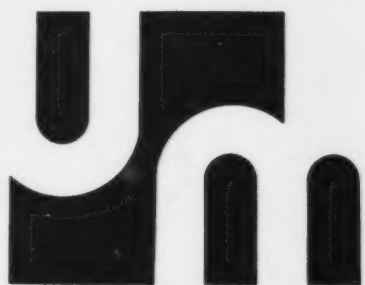
This training manual provides information needed to meet the minimum EPA standards for certification as a commercial applicator of pesticides in the general pest control category. The text discusses general, parasitic and miscellaneous pests such as ants, ticks, and spiders; fabric, wood-destroying, and grain pests such as beetles, termites, and moths; and vertebrate pests including rats, mice, and rodents. (CS)

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# GENERAL PEST CONTROL-INDUSTRIAL manual 95

This manual was developed in cooperation with The Missouri Department of Agriculture and the Coop Extension Service, University of Missouri.

Assembled by Members of Extension Pesticide  
Training Team

5E 024 670

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## INTRODUCTION

This training manual is intended to provide information needed to meet the minimum standards of the Environmental Protection Agency. It is also intended to aid you in your preparation to take an examination for pesticide certification given by the Missouri Department of Agriculture. This training manual will not provide all the information needed for effective General Pest Control, Industrial. Additional information in the form of publications and short courses can be obtained from the University Extension Centers.

This material was adapted to Missouri conditions from an interim copy of a manual developed by Gary W. Bennett, in cooperation with an editorial committee, under an EPA grant.

## PEST CONTROL AND PESTICIDES

Proper identification and a knowledge of pest development and behavior are the keys to effective pest control. This usually involves the use of pesticides, but more and more pest control specialists are turning to sanitation as a control device. Removal of food, water and habitat (place in which to live) are very important considerations for effective pest control, and when integrated with appropriate chemical control measures, a more lasting control is possible. Control also includes the use of traps, screens and other mechanical devices to catch or prevent pests from entering.

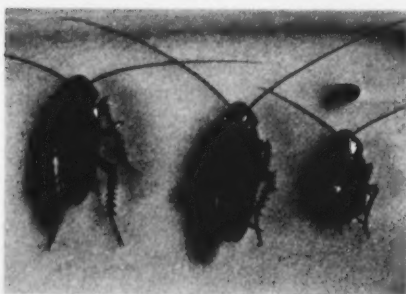
After the pest control specialist has inspected and identified the pest problem, he must then determine his course of action. If a pesticide is needed, he should select one that has label clearance for the intended use and one that is safe and appropriate for the job to be done. He must then decide how the pesticide is to be used:

# COMMON HOUSEHOLD PESTS

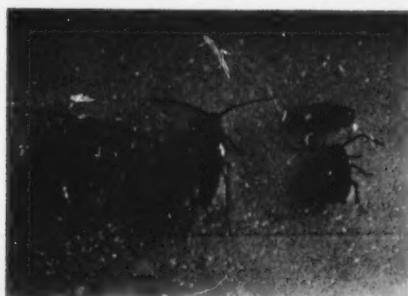
For safe and effective use of insecticides, always identify the problem correctly.



1. Oriental cockroach



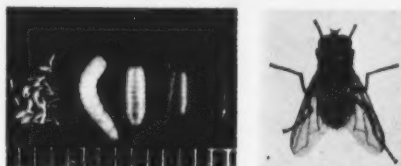
2. American cockroach



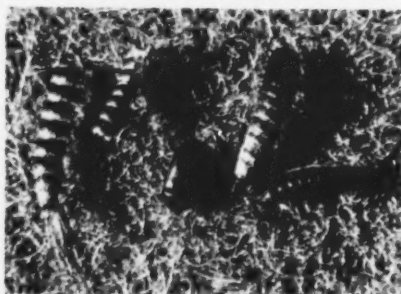
3. German cockroach



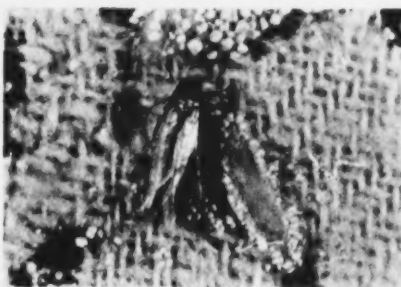
4. Brown-banded cockroach



5. House fly



6. Black carpet beetle



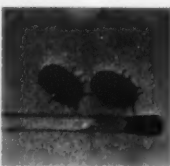
7. Webbing clothes moth



8. Silverfish



9. Flea  
(greatly enlarged)



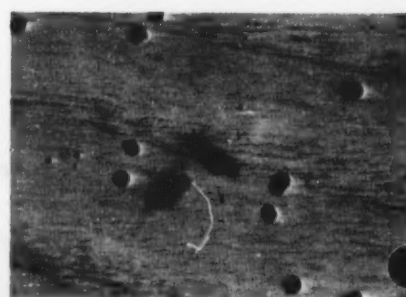
10. Brown dog tick



11. Pavement ant



12. Subterranean termite



13. Powder-post beetle



14. Carpenter ant



15. Boxelder bug

# Common Household Pests of Missouri

Leroy Peters, Department of Entomology, College of Agriculture

Fifteen household and structural insect pests, common to Missouri, are pictured on the other side of this sheet. Unless otherwise indicated the pictures are about life size.

## DESCRIPTION

1. The **Oriental cockroach** is about one inch long and is dark brown or black in color. The wings of the adults do not extend past the tip of the abdomen. This insect is most commonly found in dark, damp basements, around drains or moist areas.
2. The **American cockroach** is the largest of the roaches that infest buildings in Missouri. The adult is about 1½ inches long, reddish-brown in color, and has fully developed wings. This insect is frequently found in restaurants, grocery stores, bakeries, and other food storage and preparation areas.
3. The **German cockroach** is one of the most common cockroaches found in homes. The adults are about ¾ inch long. This species is found around the kitchen, under sinks, in cupboards, around and under refrigerators and stoves, and behind baseboards.
4. The **brown-banded cockroach** is often confused with the German cockroach. However, it is slightly smaller, about ⅝ inch long, and there is a cross-band of light yellow at the base of the wings and another 1/16 of an inch further back. The brown-banded cockroach may be found in any part of the house: under tables and chairs; in cupboards and cabinets; behind picture frames; in clocks, radios, TV sets and in other furniture.
5. Eggs, a larva, pupae and an adult of the **house fly** are pictured. This is one of the most common household pests during the warmer months of the year.
6. The **black carpet beetle** and larvae are pictured about two times normal size. This species and several related species feed on woolen clothes, carpets, furs and upholstered furniture.
7. The **webbing clothes moth** is pictured about two times life size. This species and a related species of clothes moth damage the same materials as do the carpet beetles. Adult clothes moths prefer dark areas.
8. **Silverfish** are common in houses where they cause damage by eating materials that are high in protein, sugar or starch. They eat cereal; moist wheat flour; paper on which there is glue or paste; sizing on paper, particularly wall paper; book bindings; and starch in clothing. The adults are about ½ inch long and are wingless. Silverfish live and develop in damp, cool places. They are active at night.
9. The **flea** shown here is greatly enlarged. Fleas may become a problem in any home where cats or dogs are allowed to sleep inside. The eggs of fleas are laid in bedding material and the larvae that hatch from these eggs, feed on dried skin, hair and other organic materials. The adult fleas feed on warm blooded animals, such as cats, dogs or humans.
10. Where dogs are allowed to sleep in the house, **brown dog ticks** may also become a problem. These ticks seldom feed on other animals, but may become a nuisance in houses. After ticks feed on the dog they drop off and seek concealment within the house, behind baseboards, window and door facings, pictures, light fixtures and furniture.
11. Several species of **ants** may be found in the house. Some nest outside and some nest inside the homes. Ants are usually found in the kitchen where they are attracted by sweets or grease.
12. The **subterranean termite** causes more damage to houses than any other species of insect found in Missouri. The nest of the subterranean termite is always in the soil. The principle food is cellulose obtained from wood. Their feeding and damage is concealed. Termites are exposed to light only when the winged forms swarm.
13. Several species of **powder-post beetles** may cause damage to homes. The larvae feed on the starch or cellulose in the wood and as they feed, they bore irregular tunnels through the wood. The powdery borings may be pushed out. Pin head size holes and powdery wood dust in flooring and other infested wood are signs of a powder post beetle infestation.
14. **Carpenter ants** are the only species of ants that may seriously damage the wood of the house. Unlike termites these ants do not feed upon the wood.
15. **Boxelder bugs** may become pests in the home each year in early autumn. Boxelder bugs normally feed on the leaves, flowers and seed pods of boxelder trees. In early fall they migrate to houses searching for a place to spend the winter. During warm days in the winter and early spring they come out and scatter throughout the house. They cause no damage or injury within the house.

## CONTROLLING HOUSEHOLD INSECTS

For control recommendations see *MU Guide 7360, "Boxelder Bug"*, *MU Guide 7384, "Cockroaches"*, and *MU Guide 7388, "House Fly Control in and Around the Home"*. Additional information on household pests is available from University Extension Centers, pest control operators, and pesticide dealers.

- for a space spray, he might use an insecticide in oil
- for long residual activity in a dry situation, a dust
- for a surface application of a residual where appearance is not too important, a wettable powder
- for use around open flames and heat, an emulsion
- for spraying on or around plants, wettable powder or selected emulsion
- for use on or around linoleum, rubber, asphalt floor tiles, and some synthetic fibers, a water-base insecticide

Although the various formulations can be used on a wide variety of jobs and in many different types of equipment, each has its own particular characteristics. They help determine which is the best to use in a given situation. (See pesticides and application equipment sections of the core manual for more detailed information.)

The Environmental Protection Agency, published in the Federal Register of September 5, 1975, Pesticide Enforcement Policy Statement No. 2 (PEPS), which authorized the use of registered pesticides for the control of unnamed target pests in structural pest control. It lists a number of requirements that must be complied with, the degree of competency of the applicator, and a number of restrictions on the site of application.

#### USING PESTICIDES SAFELY

The pest control specialist must not allow pesticides to be released into the soil, air, or water except where he intends to do so as a safe and approved part of his work. Pesticides put in the wrong place, on the wrong plant, or where the wrong animal can contact or consume them are pollutants and can cause serious harm.

The specialist also has to be particularly aware of

sensitive areas such as food handling establishments and areas where young, elderly, or ill persons are located. Careful consideration of pets and their eating places must be kept in mind. Pesticides used in or around such areas should be the safest ones available that are effective, and they should be applied in such a manner that contamination does not occur. (See using pesticides safely section of the core manual for additional information.)

## GENERAL PESTS

### Cockroaches

There are four species of cockroaches commonly found throughout the United States. They vary somewhat in appearance and habits, but in general they are all rather large, flattened insects, brownish or dark in color and fast-running. Cockroaches seek concealment in the daytime and also when disturbed at night. They may be carried into buildings in boxes, beverage cases and produce such as potatoes. In apartments and larger buildings, they readily migrate from one area to another along water pipes. Some species even enter structures from outdoors or come in through sewer openings.

#### The German Cockroach (Picture Sheet 2, Figure 3)

- a common species found in kitchens
- adults are about 5/8 inch long
- tan in color with two dark stripes running lengthwise on the area just behind the head
- often occur in large numbers

#### The American Cockroach (Picture Sheet 2, Figure 2)

- reddish-brown
- largest of the common cockroaches (about 1-1/2 inches long as an adult)

- found in dark, moist areas such as basements, sewers, and steam heat tunnels

The Oriental Cockroach (Picture Sheet 2, Figure 1)

- about one inch long as an adult
- shiny black or very dark brown
- female has small wing pads while the wings of the male cover about 3/4 of his abdomen
- frequently found in damp places such as basements and may enter buildings through sewer openings
- may live outdoors during the summer months and move from home to home

The Brown-banded Cockroach (Picture Sheet 2, Figure 4)

- about 1/2 inch long
- brown with two lighter bands across the base of the wings and abdomen
- may infest the entire building
- infestations usually start from luggage, furniture or other materials shipped from one place to another

In certain areas of the country, other cockroach species are of economic importance. Some of these are very similar in appearance to those described above, but differ in their habits. As a result, proper identification is essential to control.

Before applying insecticides, explore sanitation. The destruction of breeding places and the removal of food and water sources are often essential in obtaining a satisfactory level of cockroach control.

Successful cockroach control depends largely upon proper insecticide application. In kitchens and living areas, apply the insecticide as a crack and crevice or spot treatment into places where the insects hide. In

HOW AREAS MAY BE TREATED IN FOOD ACCOUNTS (EXCLUDING U.S.D.A. MEAT)

| PESTICIDES THAT MAY<br>BE USED AT<br>FOOD ACCOUNTS | INSIDE AREAS                    |                             |                                 |                                                        |                                 | OUTSIDE<br>AREAS        |
|----------------------------------------------------|---------------------------------|-----------------------------|---------------------------------|--------------------------------------------------------|---------------------------------|-------------------------|
|                                                    | AREAS WHERE FOOD MAY BE EXPOSED |                             |                                 | AREAS WHERE FOOD OR FOOD<br>SURFACES ARE NEVER EXPOSED |                                 |                         |
|                                                    | CRACK and<br>CREVICE ONLY       | SPOT LESS<br>THAN 2 SQ. FT. | GENERAL: MORE<br>THAN 2 SQ. FT. | SPOT LESS<br>THAN 2 SQ. FT.                            | GENERAL: MORE<br>THAN 2 SQ. FT. |                         |
| 1. CYCON SPRAY                                     | NO                              | NO                          | NO                              | NO                                                     | NO                              | YES                     |
| 2. BAYTEX SPRAY                                    | NO                              | NO                          | NO                              | NO                                                     | NO                              | YES                     |
| (SEVIN)<br>3. INSIDE RESIDUAL DUST                 | YES                             | NO                          | NO                              | YES                                                    | NO                              | YES                     |
| 4. KEPONE BAIT                                     | NO                              | NO                          | NO                              | YES                                                    | NO                              | YES                     |
| 5. BAYGON BAIT                                     | YES                             | NO                          | NO                              | YES                                                    | NO                              | YES                     |
| 6. BAYGON SPRAY                                    | YES                             | NO                          | NO                              | YES                                                    | NO                              | YES                     |
| 7. DIAZINON SPRAY or<br>DUST                       | YES                             | NO                          | NO                              | YES                                                    | NO                              | YES                     |
| 8. DURSBAN SPRAY                                   | YES                             | NO                          | NO                              | YES                                                    | NO                              | YES                     |
| 9. MALATHION SPRAY                                 | YES                             | YES                         | YES                             | YES                                                    | YES                             | YES                     |
| 10. DDVP SPRAY                                     | YES                             | YES                         | YES                             | YES                                                    | YES                             | YES                     |
| 11. PYRETHRINS SPRAY                               | YES                             | YES                         | YES                             | YES                                                    | YES                             | YES                     |
| 12. PYRETHRINS DUST                                | YES                             | NO                          | NO                              | YES                                                    | NO                              | NORMALLY<br>INEFFECTIVE |

THIS CHART COURTESY OF THE TERMINIX INTERNATIONAL, MEMPHIS, TENN., Prepared by VERN WALTERS

commercial food handling areas, there are several pesticides which can be used for crack and crevice treatment but only a very limited number for application to larger areas (see page 4A). Before using any pesticide in these areas read the label and make certain the formulation being used is labeled for such use. Common "hide-outs" are behind and beneath built-in shelves and cabinets, in and beneath stoves and refrigerators, under sinks and behind baseboards.

In basements, cockroaches hide beneath trash, old papers, in cupboards, washing machines, shelves, and cracks and crevices in concrete block walls. Pest control can be obtained by treating the entire area where cockroaches hide. Always follow label directions and precautions.

Sprays are preferred to dusts for cockroach control because they are easier to apply and the deposits are invisible. Dusts, on the other hand, can sometimes be blown into places difficult to reach with a spray.

ULV and aerosol applications of contact sprays and flushing agents are useful in some control situations. These applications should be used to supplement residual sprays and dusts except in areas where the use of residual insecticides is prohibited.

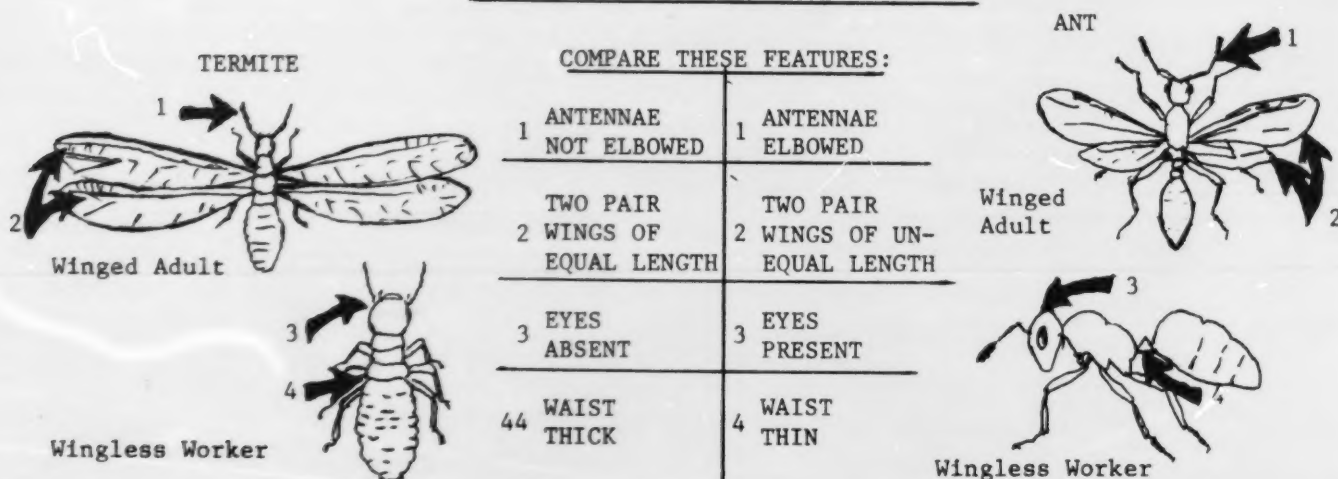
#### Ants

Ants can be a problem in and around the home and other structures. Most species build their nests in soil. Those that invade buildings usually nest near foundation walls or under concrete slabs. One species, the carpenter ant, builds its nest in hollow trees, stumps, and sometimes in the timbers of buildings.

- ants have a narrow "waist" like a wasp; termites a straighter body and no waist

- ants have two pairs of wings of unequal length;  
termites have two pairs of wings of equal length.
- ants have elbowed antennae while termite antennae  
are straight

#### FOUR WAYS TO TELL TERMITES FROM ANTS



#### The Black Carpenter Ant (Picture Sheet 2, Figure 14)

- variable in size, measuring up to 1/2 inch long
- brown to black in color
- either winged or wingless
- construct their nests in hollow trees, logs, telephone poles, posts, porch pillars and other timber used in homes
- trademark is a small pile of coarse sawdust, usually containing insect fragments, beneath their nesting place. These nests are usually found in wood with a "higher than normal" moisture condition
- does not consume wood, but simply hollows it out to form nests
- can weaken building structures

The secret to control of ants, whether they be carpenter ants or other indoor or outdoor nesting ants, is direct treatment of the nests. In the case of carpenter ants, look for the piles of sawdust to locate the entries. Then blow dust into the nesting area. Other species may

SOME ANT PESTS OF HOUSES IN MISSOURI

| NAME OF ANT            | NEST LOCATION                                          | ANTS IN NEST                 | COLOR OF ANT                                        | SIZE WORKER     | FOOD                                  | TYPE DAMAGE                                      | COMMENTS                                            |
|------------------------|--------------------------------------------------------|------------------------------|-----------------------------------------------------|-----------------|---------------------------------------|--------------------------------------------------|-----------------------------------------------------|
| Black Carpenter Ant    | Trees, stumps, logs, houses                            | a few up to 3,000            | variable but typically black                        | 6 to 13 mm.     | insects, meat sweets, fruit eggs      | excavations in wood                              | needs water                                         |
| Red Carpenter Ant      | Trees, under rocks, houses                             | a few hundred to 3,000       | rust colored                                        | 6 to 13 mm.     | insects honeydew fruit                | excavations in wood                              | seldom a serious pest in houses                     |
| Acrobatic Ant          | Roof, siding, under porch, behind brick or rock veneer | 10,000 to 25,000             | head & thorax reddish brown to black, abdomen black | 2.6 to 4 mm.    | honeydew sweets meats                 | none-usually a nuisance may enlarge nest in wood | workers bite                                        |
| Odorous House Ant      | In house, fields, nearly any place                     | Few hundred to many thousand | brown to black                                      | 2.4 to 3.25 mm. | honeydew sweets, meats dairy products | none - just annoying                             | odor like rotten coconut                            |
| Pharaoh Ant            | In buildings                                           | Up to one million or more    | yellowish to light brown, reddish                   | 2 mm.           | sweets, meat grease general           | reported to damage rubber goods & silk           | workers one size. very persistent                   |
| Thief Ant              | Any place in house                                     | 600 to 3,000                 | yellowish to brown                                  | 1.3 to 1.8 mm.  | seeds, meat, sweets, general          | apparently none - just annoying                  | feed on stores in other ant nests. worker one size. |
| Cornfield Ant          | Logs, in soil, lawns                                   | several thousand             | brown to blackish                                   | 2 to 2.5 mm.    | sweets, meat, honeydew                | none - just annoying                             | very numerous in lawns                              |
| Larger Yellow Ant      | Rotten wood, along foundation walls, under walks       | several thousand             | yellowish                                           | 4 to 4.5 mm.    | honeydew                              | soil from nest                                   | move plant lice from plant to plant                 |
| Little Black Ant       | Faulty wood, under rocks, in soil, masonry             | 25,000 to 30,000             | shiny black                                         | 1.5 to 2 mm.    | meats sweets general                  | none                                             | can adapt to the situation. workers one size        |
| Pavement Ant           | Under rock & sidewalks, walls of houses                | 50,000 to 100,000            | light brown to blackish                             | 2.5 to 3 mm.    | honeydew, seeds, meat grease          | may cause rash on humans                         | workers one size                                    |
| Neivamyrmex nigrescens | Along foundation walls                                 | 150,000 to 250,000           | brown to reddish brown to black                     | 2.8 to 5.8 mm.  | other ants, termites, meat, beetles   | none - just annoying                             | polymorphic petiole 2 segments                      |

nest in soil around the foundation or out in the lawn. These can be controlled by applying an approved emulsion, wettable powder, or granular form of insecticide directly to the nest and surrounding area.

Houses built on concrete slabs often have serious ant problems. The insects nest under the slabs and enter through cracks, heating ducts and utility openings. Here, again, it is important to locate and apply insecticide to the nest.

However, if ants still get into the house, apply insecticides where the ants gain entry or hide--at foundation walls, doorways, windowsills, baseboards, behind built-in cabinets and furniture, beneath refrigerators, and other heavy appliances. Residual sprays in the areas usually work best, although dusts may be more appropriate in some areas.

For additional information on some ant pests of houses in Missouri see page 6A.

#### Wasps and Bees

Bees and wasps often are nuisances, but may also be dangerous to man because of the females' ability to inflict painful stings, usually in defense of their nests.

Paper wasps include the single comb wasps (commonly referred to as Polistes wasps), hornets, and yellow jackets. Single comb wasps and hornets build paper-like nests under eaves of houses, in shrubs, and other protected places. Hornet nests are easily recognized as the large, covered, greyish-brown paper structures usually seen hanging in trees or bushes. Single comb wasp nests are uncovered and have the combs of the nest exposed. Yellow jackets often build their nests underground. All of these wasps vary in color. As a

general rule the hornets are largest (about 1-1/2 inches long), the single comb wasps are intermediate in size (about 1 inch), and the yellow jackets are smallest (about 1/2 inch).

Special protective clothing is needed when controlling paper wasps. Residual sprays work well, but they must be applied with a sprayer large enough to do the job quickly without getting too close to the nest. Dusts may be blown into the nest openings of yellow jackets. Baits are also available and effective against some species of wasps.

Wasps of various sizes may dig holes in lawns or bare earth to build their nests. The cicada killer

- is large, black and yellow wasp about 1-1/2 inches long
- will not sting or otherwise cause harm if left alone (only the males buzz around people)
- can be controlled by sprinkling an approved dust at the entrances to their burrows

Mud Dauber wasps seldom become serious pests in buildings.

- so named because they construct their nests of mud in attics, eaves, and on other parts of buildings
- are usually black with yellow markings
- can be eliminated simply by tearing down their nests
- are not dangerous since they do not defend their nests and rarely sting

Bees such as the honey bee, bumble bee, and carpenter bee often become serious pests in and around buildings, not only because of their ability to sting, but in the case of the honey bee and carpenter bee, structural damage may result from their nest-building activities. Honey bees may build nests in walls, chimneys, and attics. Their combs may melt and allow honey to seep through walls

and ruin interior finishes. In addition, old honey combs sometimes become infested with other insects which may cause further annoyance. Carpenter bees may drill 1/2 inch holes into exposed wood of buildings. The holes make a 90° turn below the surface and run with the grain of the wood for distances up to 12 inches.

Bumble bees and carpenter bees look very much alike. They can be distinguished by the yellow hair on the top of the abdomen of the bumble bee and the lack of such hair on the abdomen of the carpenter bee. Bumble bees build their nests in straw, old rags or in any material that provides some insulation.

Bees can be controlled using sprays, aerosols, or dusts of approved insecticides. These materials should be injected into the nest area. Again, it is wise to wear protective clothing when treating the nests of honey bees and bumble bees.

#### PARASITIC PESTS

Many pests are pests because they feed directly upon man or other warm-blooded animals. Bedbugs, fleas, ticks and mosquitoes fall in this category. In addition to their blood sucking activities, many parasites are able to carry disease-causing organisms from one host to another.

The Bedbug may become a troublesome pest in the house.

- prefers man as its host.
- hides in cracks and crevices by day and comes out at night to feed, usually as the host sleeps
- adults are about 1/5-inch long and 1/8-inch wide, reddish-brown in color, with the body flattened and oval shaped
- incomplete metamorphosis--egg, nymph, adult

Residual sprays and dusts can be used for control, although dusts should be used in only such places as under baseboards and window and door casings. Spraying should be thorough; however, sprays should not be applied to surfaces that will come in direct contact with humans. Tufts and seams of mattresses should be treated and covered with sheets after the spray has dried.

Although there are numerous species of fleas, the cat flea is the most common one found in the home and on pets. Adult fleas live on the blood of animals and must have it in order to produce young. Fleas are small insects, lacking wings, and having piercing-sucking mouthparts (Picture Sheet 2, Figure 9). Flea infestations in homes usually become evident after the host animal (usually cats and dogs) have been removed. Fleas continue to develop from eggs previously laid and begin to bite people in the absence of normal hosts. Permanent control involves ridding the pet of fleas using labeled sprays, flea collars, or dusts, and ridding the premises of fleas using sprays. The pest control specialist can treat the premises; however, the pet should be treated by the owner or a veterinarian.

A number of ticks feed on man and his animals; however, the brown dog tick (Picture Sheet 2, Figure 10):

- is the only tick that becomes a serious household pest
- may be found on other animals, although the principal host is the dog
- will drop off the host after feeding and conceal itself in any available crack or crevice
- is often found behind cove moldings, window frames, and in furniture because of its tendency to climb

Control efforts are primarily centered indoors. It is difficult to control because of its many possible hiding

places. Since tick eggs may hatch over a period up to five months, more than one spray application to all infested areas might be necessary at monthly intervals to completely eliminate the problem. Treat all cracks and crevices, moldings, baseboards, window and door frames, and similar places where ticks might conceal themselves. Pets should also be treated using pesticides available in drug stores and pet shops, but only by the owner. Veterinarians also maintain dipping vats for treating tick-infested dogs.

Mosquitoes are blood-sucking flies.

- often occur in large numbers in the warmer months.
- adult females feed primarily on warm-blooded animals
- develop in water standing in anything from tin cans to lakes and streams

Control programs may involve area or community efforts which should be conducted only by trained personnel, or more localized efforts involving primarily the use of sprays, aerosols, or fogs for the control of adult mosquitoes.

#### OCCASIONAL INVADERS

The term "occasional invaders" includes those pests which occur in buildings at some stage of their life cycle, but which do not usually complete the entire life cycle within the building.

The Clover Mite is actually a plant feeder.

- often becomes an annoying household pest, especially in housing developments where new lawns have been established and where there is a heavy growth of well-fertilized grass close to foundation walls
- tiny, reddish-brown creatures, smaller than a pin head

- may occur in countless numbers
- usually appear first around windows, but may later overrun the entire structure
- do not bite people, but are extremely annoying
- do not cause damage indoors other than to leave a red stain when crushed
- feed on grasses, clovers and some other plants in lawns
- crawl into cracks and crevices to molt and to lay eggs
- most abundant in fall and spring months
- migrate into homes as they search for food, water or protection from unfavorable environmental conditions

Clover mites are difficult to control, and considerable time and effort may be necessary to eliminate them. Prevention is better than cure. Best results are obtained by following procedures that keep the mites from getting indoors. Once inside, they can be killed with certain sprays, but more are likely to show up. Preventive measures involve removing grass and shrubbery growing against foundation walls and establishing a plant-free barrier 18 to 24 inches wide along foundation walls. Spray the barrier strip and foundation walls of the building with a miticide. If no barrier strip is present, treat the foundation walls and also the vegetation itself for a distance to 10 to 20 feet outward from the foundation.

Millipedes sometimes invade buildings.

- scavengers whose diet consists mainly of decaying vegetative matter
- commonly found in wooded areas, compost piles or heavily mulched areas
- two pairs of short legs on each body segment
- gray or brown in color and 1/2 to 1-1/2 inches long
- curl up when disturbed

On occasion, millipedes leave their natural habitats and crawl about over lawns, sidewalks, and invade buildings in large numbers. Although they cause little or no damage, their presence is usually undesirable. Invasion can often be prevented by removing leaves, compost, and general refuse from around buildings, and by sealing any cracks in foundation walls and around doors, basement windows, and similar openings.

Spraying outdoors with a residual insecticide in a 10-foot wide strip around the foundation is helpful in control, although repeat applications may be necessary.

### Flies

Several species of filth flies may be encountered around the home. The more common of these are the house fly (Picture Sheet 2, Figure 5) and the black blow fly. The black blow fly is slightly larger than the house fly and is a shiny black or green. These flies are important pests, not only because of general annoyance, but also because they carry such diseases as dysentery, diarrhea, food poisoning, and typhoid fever. Therefore, fly control should be viewed as an important part of good health and sanitation.

Fly control is most successful when it includes a combination of good sanitation, screening, and the use of insecticides. Fly breeding areas such as garbage, pet manure, and all other decaying plant and animal matter should be removed. Residual sprays can then be applied outdoors to fly-resting places. Poison baits can also be used, but treatments must be repeated. They are best used to supplement a spray program. Indoor fly control is best accomplished by using a contact spray or aerosol or by the use of impregnated resin strips.

The Cluster Fly and Face Fly will overwinter in walls and attics.

- often a pest indoors, buzzing around and collecting in large numbers at windows on warm, sunny days
- cluster fly is slightly larger than the house fly and more sluggish
- face fly is very similar to house fly in size and color
- adults seek protected places such as walls and attics in the fall to spend the winter
- screens are ineffective since the flies prefer to crawl in through small openings elsewhere
- on warm days, they enter rooms through window pulley holes, around baseboards, and through other small openings

Control is difficult because this fly hibernates in inaccessible places. If possible, all openings through which the flies can enter should be closed and sealed. Sprays and dusts can be used to spray surfaces where flies are frequently seen and, where possible, into wall voids and other confined spaces where the flies may be. Contact aerosol sprays can be used to kill the flies that buzz about rooms. In unventilated areas impregnated resin strips are very effective.

#### MISCELLANEOUS PESTS

The term "miscellaneous pests" apply to those pests which usually complete their life cycle within the confines of a building.

Silverfish and Firebrats (Picture Sheet 2, Figure 8) are wingless, boat-shaped insects about 1/2 inch long as adults with three long "bristle tails" at the end of their body. They feed on stored foods, paper, and most anything containing proteins and carbohydrates. Residual sprays applied to all hiding and resting areas are most frequently used for control; however, dusts and baits may also be useful.

Booklice, or Psocids, are very small (1 to 2 millimeters long), light-colored insects that may be found indoors or outdoors. Indoors they frequent damp places around stored foods, in crawl spaces under houses, and around books. They feed on microscopic molds and fungi. They do no damage and are pests only by being present, often in tremendous numbers. Occasionally they are serious pests in factories that manufacture food containers such as cans. Control can sometimes be accomplished simply by removing their moisture and food sources. Residual sprays and non-residual mists and aerosols in and around infested areas are also effective.

Spiders are usually nuisances due to their webbing activities. Some people have the idea that all spiders are poisonous, but only the black widow (Picture Sheet 11, Figure 6) and the brown recluse or fiddleback spider (Picture Sheet 11, Figure 5) are capable of inflicting serious injury to humans. Neither spider will bite unless provoked. The female black widow is shiny black and distinctively marked with a red or yellow "hour glass" on the underside of its abdomen. This spider lives in undisturbed situations, such as under rocks and boards and in protected areas around buildings.

The brown recluse is aptly named since it is a reclusive spider. It is usually found in buildings such as barns, sheds, garages or even homes that are dry, littered, undisturbed and contain a supply of insects to serve as food. Favorite hiding places seem to be the arms or legs of garments left hanging undisturbed for some time. People have sometimes been bitten while sleeping in beds that have previously been unoccupied for some time. This spider is characteristically tan to brown with a dark brown fiddle-shaped pattern on the front half of its back.

# STINGING AND BITING PESTS

For safe and effective use of insecticides, always identify the problem correctly.



1. Deer fly (sucks blood)



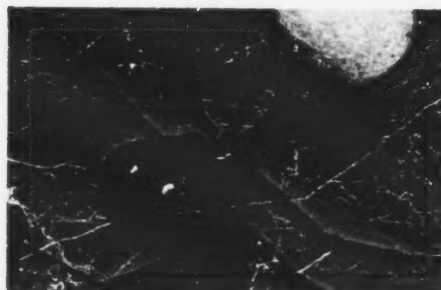
5. Brown recluse spider (poisonous bite)  
and close-up of "fiddle-shaped" marking on back



8. Yellow jacket (stings)



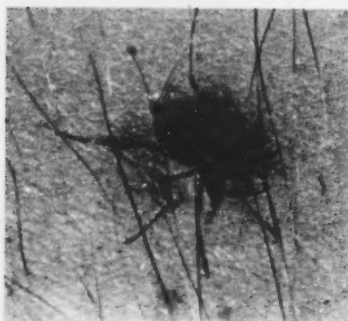
2. American dog tick  
(attaches and sucks blood)



6. Black widow spider (poisonous bite)



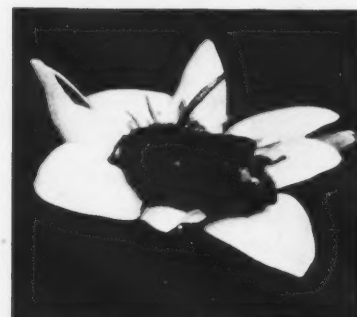
9. Sweat bee (stings)



3. Mosquito (sucks blood)



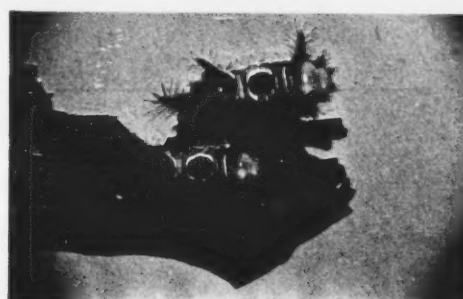
7. lo moth larva (stinging hairs)



10. Honey bee (stings)



4. Wheel bug (punctures skin)



11. Saddleback caterpillar (stinging hairs)

# Stinging and Biting Pests

*Wilfred S. Craig, Department of Entomology, College of Agriculture*

1. Deer Fly—There are several species of these small, grayish brown, biting flies. They are close relatives of horse flies and suck blood from wild animals, horses, cattle, and man. The masses of eggs are deposited on blades of grasses and cattails in marshy areas.
2. The American dog tick is not an insect. This tick will attack man, dogs, many wild animals, horses, cattle and hogs. It feeds by inserting its mouth parts into the flesh of the host and taking a blood meal. The feeding activity is seldom painful and may go unnoticed by the victim.
3. There are many species of mosquitoes which will suck blood from man, animals and birds. Some of these species transmit serious diseases such as malaria and yellow fever. The larvae of mosquitoes, often referred to as wigglers or wiggle tails, are frequently present in water catch basins, barrels, stagnant pools and other standing water.
4. The wheel bug gets its name from the gear-like structure on its back. It is one of the assassin bugs and is generally considered beneficial since it preys on other insects. A wheel bug can inflict a serious wound if picked up or is accidentally caught in the clothing. The piercing mouth parts can easily puncture skin. An irritant, which is injected, will cause intense pain and may result in severe swelling of the affected area.
5. The brown recluse spider is common in many parts of Missouri. The "fiddle-shaped" dark brown marking on the back of the spider is an identification aid. The bite can cause severe pain and a necrosis of flesh at the point of bite. If a person is bitten by this pest it is wise to contact a physician immediately.
6. The black widow spider is the only other poisonous spider present in Missouri. The adult spider is black and the female has a red hourglass-shaped marking on the underside of the body. The effect of the venom is usually severe pain, and a slight swelling in the affected area. If bitten by a black widow spider contact a physician immediately.
7. The larva of the Io moth is rather attractive in coloration. The body has tufts of stout spines and hairs arranged in rows. The spines will penetrate the skin, break off near the tip and allow a poison to enter which causes a burning sensation in the affected area.
8. Yellow jackets usually build their paper nests in holes in the soil. The females all have stingers and are willing to use them on any creature that threatens or disturbs the nest.
9. Several species of small bees are referred to as sweat bees. They alight on man to secure moisture, "sweat", from the skin and if they are squeezed or accidentally pressed with clothing may sting.
10. The honeybee, a very beneficial insect, will inflict a painful sting if its hive is disturbed or if handled without proper care.
11. The saddleback caterpillar, the larva of a rather attractive small moth, has clumps of poisonous spines on its body. When picked up or accidentally rubbed, these spines puncture the skin and discharge a poison. Although somewhat painful, the poison seldom has a serious effect on humans.

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Spider control can best be accomplished through sanitation plus the use of a residual spray in hiding and nesting areas. Dusts and aerosols can be used in attics and crawl spaces. Sanitation should include cleaning away all webbing with a vacuum cleaner and the removal of as many of their hiding areas as is possible.

#### FABRIC PESTS

Clothes moths and carpet beetles may attack a variety of things, but they do greatest damage to woolen products, furs, feathers, and hair. Infestations are common in boxes of old clothing, old overstuffed furniture, woolen carpets and rugs, and piano felt. The damage is done by the larval stage, although the presence of adults in an area may be the first indication of an infestation.

The Black Carpet Beetle (Picture Sheet 2, Figure 6)

- the most widespread and damaging of the carpet beetles
- adults are shiny black and about 1/8 inch long
- larvae are yellowish-brown, carrot or cigar-shaped with a long brush of tail bristles, and up to 1/2 inch long

Other carpet beetles are frequently found in houses.

- adults are oval-shaped, about 1/8 inch long and brightly colored with various patterns of white, brown, yellow and orange scales on the back.
- larvae are fuzzy, slow-moving, light brown to black, and about 1/4 inch long

The most economically important clothes moths are the webbing clothes moth (Picture Sheet 2, Figure 7) and the casemaking clothes moth. The webbing clothes moth adult is buff-colored with a wingspread of less than 1/2 inch. Its head has reddish hairs on top while the casemaking clothes moth is light brown and has three

dark spots on each wing. The larval stage of the webbing clothes moth usually spins feeding tunnels of silk, but may produce somewhat randomly placed patches of silk as they move about their food source. The casemaking clothes moth larva rarely spins any webbing but does spin a small silken case around itself that it carries while feeding. It usually attaches the case to some object before it enters the pupal stage.

Prevention is a very important part of fabric pest control since one small hole in a suit or some other fabric may completely ruin the item. The proper cleaning and storage of fabrics is important in preventing damage. Dry-cleaning and the use of moth-proofing solutions are effective for a limited period of time. When storing fabrics, moth crystals or flakes are quite effective; however, the fabrics should be thoroughly cleaned before being placed in tight storage. The control of existing infestations can be accomplished by treating all infested areas with a residual spray labeled for this use.

#### WOOD-DESTROYING ORGANISMS

##### Termites

Termites are social insects having colonies in which there is a division of labor between different types of individuals. Nearly all species have reproductive and soldier castes, and many have a worker caste. If a worker caste is lacking, the nymphs handle the nest building and food gathering activities. These workers are responsible for damage done to structures. Within the reproductive caste are primary reproductives which are winged. They emerge from the colony during the warmer months of the year to disperse and form new colonies. (See ant section, page 6, for a description of these swarmers.)

Subterranean Termites (Picture Sheet 2, Figure 12)

- so named because the colony is usually located below ground, with the workers moving into wood above ground
- white, soft-bodied workers, although seldom seen, eat the soft grain of wood, leaving a thin shell outside and a splinter effect inside
- build shelter tubes from bits of soil and excrement, which they also use to close up breaks in the surface of infested wood.

Termites need wood for food and soil for moisture. Wood in contact with soil is ideal for termite development. But if this does not occur, the insects may build shelter tubes to bridge or span foundation walls and other masonry that separate wood from soil. Tubes are constructed on foundation walls or inside them if voids or cracks permit. Occasionally termite colonies are established without soil contact when a leaky roof or pipe provides moisture.

Infestations often develop in soil under slabs of concrete such as garage floors, patios, and filled porches. From there, the termites enter the building through structural wood or foundation walls adjacent to the slab. In cases of houses built partly or completely on slabs, infestation is through expansion joints, cracks, and utility openings.

The basic principle of termite control is to break the connection between wood and soil. This is done by laying down a chemical or physical barrier to eliminate all possible points of entry.

Soil on both sides of exposed foundation walls and soil surrounding supports should be soaked down to the foundation footing with the proper dilution of an approved termite control chemical at a rate of 4 gallons per 10 linear ft per

foot of depth. Application is made by trenching or a combination of trenching and rodding.

For outside basement walls (where the footing is deep) a v-shaped trench is dug against the wall. It should be at least a foot deep, or deeper, to insure penetration to the footing. After trenching a perforated hollow rod should be used to inject insecticide to the footing of the basement wall at the rate mentioned above. When treating concrete block or brick foundation walls, they should be drilled above the grade line and all voids flooded with 2 gallons of the properly diluted insecticide per 10 linear feet.

Treating slab-constructed buildings involves saturating much of the soil beneath the slab. The chemical is injected either (1) through holes drilled in the slab at 12-16 inch intervals next to all foundation walls, cracks in the slab and utility openings, or (2) by drilling and rodding horizontally through the foundation wall from outside the building to reach the same key areas. Either method must be carefully executed since heat pipes, vapor barriers, etc. may be located under the slab. If treating by method 1, insecticide should be applied at the rate of 4 gallons per 10 linear feet. If saturating beneath the slab by method 2, the insecticide rate is 1 gallon per 10 square feet.

Filled porches are treated one of two ways. (1) The slab can be drilled from the top as described above or the porch foundation drilled horizontally at each end next to the building, and the chemical injected by rodding. Or (2) by making openings in the foundation wall and digging out the porch fill immediately under the slab next to the building foundation. Then treat the soil with 4 gallons of properly diluted insecticide per 10 linear feet. Also spray the fill surface, the

foundation wall and undersurface of the slab.

Dry-wood Termites are seldom a problem in Missouri.

- unlike subterranean termites, bore directly into wood and make their nests in the wood rather than below ground
- as they feed, they cut across the grain of wood excavating large chambers which are connected by small tunnels
- produce distinguishing excretal pellets that are hard and have six distinct concave surfaces on the sides. These pellets are often pushed out of the colony through small holes in the wood.

Since dry-wood termites do not require any contact with the ground, treatment is quite different than for subterranean termites. It consists of covering the building with a gas-tight tarpaulin and fumigating the entire structure with a toxic gas. In minor infestations, a toxic liquid or dust may be introduced through holes drilled into the excavated chambers. Furniture and other movable objects are frequently infested and must be treated in the same manner or by chamber fumigation.

Powder-post Beetles may be serious pests in buildings. Although there are several kinds of powder-post beetles, the most commonly encountered ones fall into two groups, the Lyctid powder-post beetles (Picture Sheet 2, Figure 13) and the Anobiid powder-post beetles. The adults are small (about 1/5 inch long) and usually reddish-brown to nearly black. They all damage wood in about the same manner and require the same control measures. The surface of infested wood is perforated with numerous small "shot holes", each about the size of a pencil lead. Any slight jarring of the wood causes a fine

powder to sift from these holes. When cut or broken, the interior of infested wood may reveal masses of this finely-packed powder which is produced by the feeding of grub-like larvae. Joists, sub-flooring, hardwood flooring, sills, plates and interior trim are the parts of buildings most frequently attacked. In addition, furniture and other wood products may be damaged.

Treatment involves spraying infested wood with an approved residual insecticide. All surfaces being treated must be thoroughly wetted for effective control. Chamber fumigation is often used for furniture and other movable objects.

Long-horned Beetles are large (1/2 to 3 inches long), conspicuous beetles with long, thin antennae which may be longer than the body. Eggs are usually laid on unseasoned, rough-sawn timbers or logs. The larvae, called round-headed borers, feed on the wood. The larvae bore large oval-shaped holes as they move through wood. The only species that will attack timbers in a building is the old-house borer, and therefore, is the only one requiring control measures. The adult is about 3/4 inch long, greyish-brown to black with two white patches on the wing covers. Damage is usually limited to pine sapwood and can be recognized by ripples on the surface of the galleries.

If the old-house borer is to be controlled, infested timbers must be drilled and pressure-treated to force the toxicant throughout the gallery system. Only in this manner can the larvae be killed since they may be considerable distances from the obvious points of infestation. In some cases, tarpaulin fumigation may be required.

Wood Decay Fungi occurs only in wood having a moisture content greater than 20 percent. Most decay or rot fungi grow only on wood which is subject to wetting by contact with moist soil, rain, plumbing leaks, or condensation. Two rare species, however, can conduct water directly to wood. Decay fungi, which are living plants that take their food from the wood as they grow, reduce the strength of wood, often making it brown and crumbly or white and stringy. Discoloration and powdery growth on wood should not be confused with decay. If the moisture content of the wood is not obvious, it must be measured with a moisture meter to accurately determine the need for treatment.

The use of fungicides or insecticides alone will not stop wood decay once it has started, though it will slow its progress in some cases. The key to the complete control of wood decay is to eliminate the source of moisture, if possible, through proper drainage, breaking wood-soil contact, ventilation, the use of vapor barriers and other good construction practices. If moisture is a chronic problem, construction lumber should be commercially pressure-treated with preservative chemicals.

#### STORED PRODUCT PESTS

Many kinds of cereal and food products and other stored products may become infested with insects commonly referred to as "pantry pests". These pests eat or contaminate the infested product, thus making it unfit for humans. They may also be annoying since they often leave the infested product and crawl or fly about the premises.

To eliminate infestations, it is necessary to find and identify the pest and then destroy or treat infested materials

and the area where they are stored. Infested materials can be cold or heat-treated, if it is desirable to keep them. The area of infestation should be thoroughly cleaned, and then treated with a residual spray. After the spray has dried, cover shelves with paper before replacing food or cooking utensils.

Grain and Flour Beetles, includes the confused and red flour beetles (Picture Sheet 1, Figure 3), the saw-toothed grain beetle (Picture Sheet 1, Figure 2), and the cigarette and drugstore beetles. All of these are small, reddish-brown beetles usually less than 1/8 inch long. Their larvae are small and yellowish-white with brown heads. The adult beetles often crawl about the kitchen or areas of infestation. Larval and adult stages all may be found feeding in the infested material.

The Granary and Rice Weevil (Picture Sheet 1, Figures 1 and 6) feed primarily on stored whole grain with their long snouts. Adults are reddish-brown to black and about 1/8 inch long. Their larvae are small, white, legless grubs that feed and develop inside individual kernels.

Cabinet Beetles, commonly referred to as Trogoderma (Picture Sheet 1, Figure 4) are general scavengers although they do prefer cereal grain products. Adults have various colored patches of scales on the back and are about 1/8 inch long. The larvae are fuzzy, light brown to black and about 1/4 inch long. The larval stages do most of the damage. Adults feed mainly on flower pollen outdoors, but may feed on stored products to some extent.

# PRINCIPAL STORED GRAIN INSECTS

For safe and effective use of insecticides, always identify the problem correctly.



1. Granary weevil



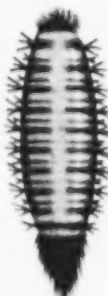
2. Saw-toothed grain beetle



3. Red flour beetle



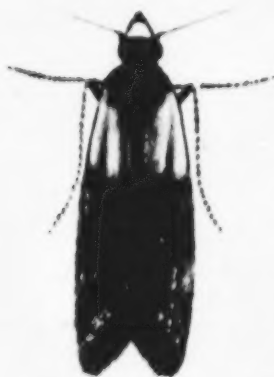
4. Larger cabinet beetle



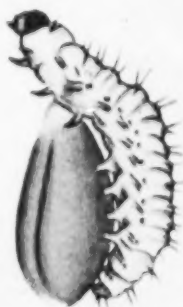
5. Lesser grain borer



6. Rice weevil



7. Indian-meal moth



8. Cadelle



9. Flat grain beetle



10. Angoumois grain moth



Some of these stored grain insects are also  
**KITCHEN PESTS.**

The saw-toothed grain beetle, red flour beetle, larger cabinet beetle, and Indian-meal moth develop in flour, cake mixes, corn meal, breakfast foods and similar products. The Angoumois grain moth infests popcorn.

# Principal Stored Grain Insects of Missouri

This is the first in a series of picture sheets prepared by Extension entomologists of the North Central states in cooperation with the Federal Extension Service, U. S. Department of Agriculture.

The principal species of stored grain insects found in Missouri are pictured showing both the adult and larval forms. The small, black drawings indicate the actual size of the insects.

## DESCRIPTION

1. **Granary weevils** cannot fly. Eggs are placed inside whole kernels. Damage is caused by the larvae feeding in whole grain and the adults feeding in and on whole or broken grain.
2. **Saw-toothed grain beetles** seldom fly but both the larvae and adults feed on cracked or broken grain, flour, meal, breakfast food, stock feed, candy, and dried fruit. The thorax, the body region behind the head, has saw-toothed points on both sides.
3. Larvae and adults of the **red flour beetle** and a closely related species, the **confused flour beetle**, feed on flour, grain dust, and broken grains.
4. **Larger cabinet beetles** and several closely related species are general feeders on grain and grain products. They will also feed on material of animal origin, such as hides.
5. The eggs of the **lesser grain borer** are placed on kernels and the larvae bore into the kernels. The adults can fly and also feed on grain.
6. **Rice weevil** adults can fly. Eggs are laid inside the kernel. The larvae feed in whole grain while the adults will feed both in and on grain.
7. **Indian-meal moth** larvae spin webs on the surface of grain and feed on kernels enclosed within the webbing. The larvae will also spin webs on sacked grain in storage areas.
8. **Cadelle** larvae and adults feed on whole grain. The larvae bore holes in the wood within bins where they hibernate. This is one of the largest stored grain insects.
9. **Flat grain beetles** are one of the smallest common stored grain insects. It is usually found associated with out-of-condition or insect damaged grain.
10. **Angoumois grain moth** eggs are laid on the outside of the grain. The larvae bore into the grain and feed within the kernel. Adults may fly from granaries and infest corn in the field.

## CONTROLLING STORED GRAIN INSECTS

For control recommendations in farm bins see UMC Guide 7100, "Insects in Farm Stored Grain—Their Prevention and Control." For control in kitchens see UMC Guides 7374, "Angoumois Grain Moth and Indian Meal Moth;" and 7376, "Saw-toothed Grain Beetle, Confused Flour Beetle, and Red Flour Beetle." These are available at your county University Extension Center.



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The Indian Meal Moth (Picture Sheet 1, Figure 7) is a small moth with a wingspread of about 1/2 inch. It is distinguished by forewings having a coppery color on the outer two-thirds and whitish gray at the basal end. The larvae are pinkish-white caterpillars that web together the materials in which they feed. The adults fly about near the site of the infestation. The larvae may also leave their food and crawl about looking for places to pupate. This is the most common moth which attacks stored food products.

The Angoumois Grain Moth (Picture Sheet 1, Figure 10) is a tiny moth similar in size and color to clothes moths. It may be seen flying about in the daytime, whereas clothes moths shun light. The larvae develop within whole kernels of grain such as popcorn.

#### VERTEBRATE PESTS

##### Rats

Rats are pests because they:

- contaminate and destroy food products
- damage furniture, clothing, buildings and other non-edible items
- carry diseases and ectoparasites
- often bite children and adults
- may cause fires
- are very adaptable in their ability to co-exist with man in his various environments

There are two main types of rats (Page 25A):

Norway, Brown, or Common Rat:

- heavy, thick-set body
- small, close-set ears
- tail shorter than the length of head and body together

- prefer to live in underground burrows but can climb readily

Roof or Black Rat:

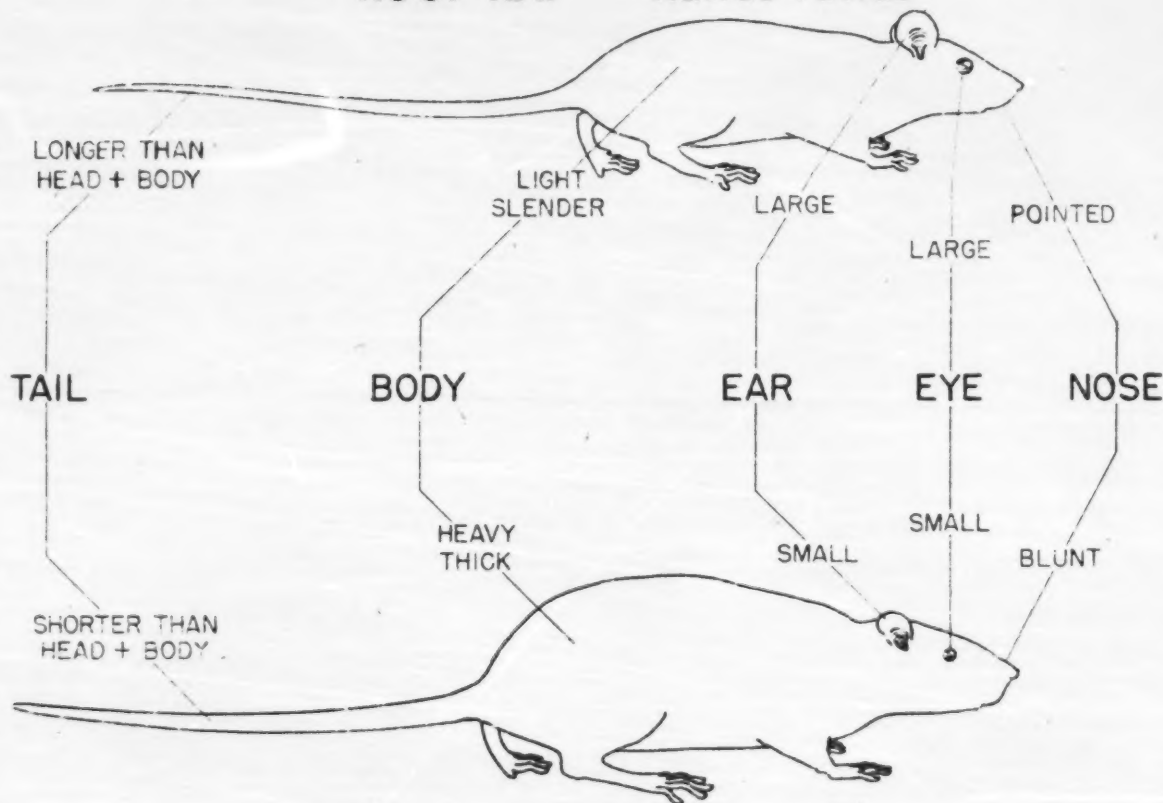
- more slender bodied than the Norway rat
- large ears
- tail longer than the length of head and body combined
- prefer to live in upper portions of a building but can use burrows

A knowledge of rat behavior is essential to successful control. Rats which have become conditioned to eating a particular food approach new food with much suspicion. If it tastes bad or makes them sick, they won't eat it again. This is "bait shyness". When baiting, more effective control can be obtained by using a bait that is fresh and identical to the food the rats are using. If different food is used, it may be necessary to pre-bait a few nights before adding a toxicant to the bait. Rats also require free water to drink. If water sources can be eliminated, liquid baits are effective. They also approach new objects cautiously and may become "trap shy" unless unset traps are used the first few nights. Rats, especially males, establish territories" and fight to preserve this area from strange males. By reducing or eliminating food sources and harborage, this competition is increased, and the rat population decreases. Rats also prefer to run next to walls or other surfaces; therefore, traps and baits should be placed in these runways.

The first part of any good rat control program consists of determining just where the rats are living, feeding, and traveling, and the extent of the infestation. Once this has been done, it is essential to eliminate their shelter areas and their food and water supplies. These sanitation measures are the backbone of successful control. However, in many instances it may be best to

# FIELD IDENTIFICATION OF DOMESTIC RODENTS

**ROOF RAT** *Rattus rattus*



**NORWAY RAT** *Rattus norvegicus*



**YOUNG RAT**



**HOUSE MOUSE**  
*Mus musculus*



SCALE IN INCHES  
0 1 2 3

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poison or trap before upsetting the environment so that the rats do not scatter. It is also necessary to close off all entrances and exists rats can use to come and go from buildings. This is called rat-proofing and must be done in many instances to obtain adequate control.

After having made use of sanitation and rat-proofing to the fullest practical extent, the remainder of the control must be done with poison baits or traps. A knowledge of rodenticides is very important since some are highly toxic to humans and pets. The two categories of rodenticides, anticoagulants and single-dose, should be mixed, handled and used according to label directions since each rodenticide has its special characteristics, uses, and hazards. However, all baits should be used in such a manner as to be inaccessible to the public and pets. They should be placed deep into burrows or in bait stations when used outdoors, and they should be disposed of along with rat carcasses as the program is completed.

In addition to anticoagulants and single-dose poisons, certain gases can be used to treat outdoor burrows. These materials can be quite dangerous and should be used only by experienced personnel.

In some situations it may be necessary to trap rats. Traps may be used with bait, or the trigger device may be expanded and used without bait. In all cases, the traps must be set in rat runways perpendicularly against the wall so rats are forced to pass over the trigger. The traps should be placed with 20 feet of each other for best results.

The House Mouse (Page 25A) can be distinguished from small rats by their small eyes and small feet. Mice cause a great deal of damage to materials, and because of their habit of nibbling, contaminate much of the material which they do not actually destroy.

A knowledge of mouse habits is also important in developing effective control programs. Each male mouse stakes out a territory. The mouse may not travel more than ten feet from his nest if food is close by or if there are many mice in the area. For this reason, baits should be placed 10 to 20 feet apart.

Mice differ from rats in that they are not suspicious of new foods and eagerly sample them. Also, mice nibble, and it may be difficult to get them to take a lethal dose of a poisoned bait. The mouse investigates any new object or change in its territory, so that changing bait or trap placements will improve control. To encourage mice to range farther to find baits and traps, their environment should be disrupted as often as practical. Mice also travel along walls or objects. Traps and baits should be set in these runways. As in rat control, sanitation and mouse-proofing should accompany the use of baits and traps. However, larger numbers of baits and traps must be used in a given area for effective control. Since many of the same rodenticides used in rat control are used against mice, the safety precautions discussed previously should be closely followed.

Birds become pests when they:

- deface and destroy building structures, plants, and other property
- cause disturbances with their noise and droppings

- carry various diseases and ectoparasites
- contaminate food supplies

Birds that often require control in urban and industrial situations are the pigeon, the English sparrow, and the European starling.

Pigeons are pests in towns and cities primarily because they deface buildings. Although the diversity of color patterns in this species is extreme, there are no other birds likely to be confused with the pigeon.

Starlings are pests both in the city and rural areas. They are dark, short-tailed birds, intermediate in size between pigeons and sparrows. They are objectionable primarily because of their habit of roosting in large numbers on or near buildings.

Sparrows are small birds but can be a nuisance out of all proportion to their size.

Sanitation, as with most other pest problems, is the first consideration in bird control. Food, water, and habitat removal are very important when they can be practically done. The different methods of bird control include: (1) building out, (2) repelling, (3) trapping, and (4) population reduction.

Building out involves using construction features or the modification of existing features so that birds cannot roost or nest. Repellents involve the use of various devices or substances installed on buildings. They include such things as noise makers (distress calls, firecrackers, etc.), ultrasonic devices, charged wires, and repellent glues or jellies. Traps are often used

successfully in pigeon control, especially when pre-baited for a few days. Population reduction includes shooting (where permissible) and poisoning. Poisoning is probably the most effective way to control birds. However, label instructions should be closely adhered to for safe and effective use.

In Missouri it is illegal to kill birds without permission from the Missouri State Department of Conservation. A permit may be obtained for a project after an explanation of the program. A pre-treatment investigation may or may not be made by a representative of the Conservation Department depending on the bird species involved.

Miscellaneous Vertebrate Pests. Other commonly encountered vertebrate pests include bats, skunks, tree squirrels, moles, and snakes.

Bats are the only mammals that can fly. Their wings are a leathery membrane stretched between the greatly elongated bones of their front legs and toes and extending, in most species, back along the sides of the body to the hind legs and tail. Bats often roost in attics, hollow walls, chimneys, and other similar places. In addition to the general nuisance and odors associated with bat infestations, they harbor ectoparasites that will attack man and are occasionally carriers of rabies. Bats can best be controlled by using a repellent to get them away from the roost and then closing all openings through which they may enter.

Skunks are of importance because of their nauseous odors. They are carriers of rabies, they damage lawns, and they harbor ectoparasites. They are usually a problem where they have gained access to the crawl space of a building.

Entrances should be sealed when the skunk is out, or a baited trap outside the building can be used to easily remove the animal to a release site.

Tree squirrels of various species may enter buildings and create a nuisance or do damage to the structure. They will also bite if cornered and may cause ectoparasite problems to occur in nesting areas. Squirrels can be controlled by sealing openings, by using repellents, or by using live traps to remove them to other areas. Where permissible, shooting can be used.

Moles are subterranean and rarely come above ground. Their burrows deface lawns and they often damage the roots of ornamental plants in searching for earthworms and insect larvae to eat. Moles can be indirectly controlled by grub-proofing lawns so that the mole has to seek food elsewhere. Several traps are specifically designed for mole control. Certain gasses are also approved for use in fumigating burrows.

Snakes of many kinds find their way into and around buildings. Most of them are not poisonous, but they do frighten humans and occasionally bite if disturbed. Sanitation (removal of food and hiding places) will usually drive snakes out of an area. To keep snakes from getting inside, all points of entry should be blocked.

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- G 7389 Face Flies and Cluster Flies in Houses--Prevention  
and Control
- G 7414 Cigarette Beetle and Drugstore Beetle
- G 7420 Termite Control in Existing Structures
- G 7421 Preventing Termite Damage at Time of Building  
Construction

These are available from local Extension offices or by writing:  
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